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Risk perceptions and adaptation decision-making at farm-scale: a Nordic case study

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Abstract

Nordic farmers are tackling climate risks with adaptation measures that also hold potential of negative outcomes ranging from economic and ecological losses to food insecurity. These adaptation processes are scarcely studied yet. In this study, the risk perceptions, adaptation assessments and adaptive actions of Finnish farmers are examined through interviewing farmers and extension officers. With a qualitative take on adaptation decision-making, the study shows how climate risk perceptions generate adaptive action in Nordic agriculture.

Keywords: *Climate risk, Adaptation process, Maladaptation, Nordic agriculture*

Introduction

Farmers continuously make adaptation decisions at farm-scale based on knowledge and experiences and guided by policies and legislation, in addition to other internal and external norms, limitations and intensives (see e.g. Grottham and Patt 2005). In the Nordic region (Finland, Sweden, Norway, Denmark), climate change induces increased precipitation and temperatures, and longer growing season which enable introducing new crops and higher yield expectations. The opportunities are hampered by the direct and indirect climate risks, related to increased weather extremes and variation, as well as the maladaptive (i.e. unintended negative) outcomes of adaptation (Noble et al 2014).

Adaptation measures in Nordic agriculture are targeted mainly towards reducing risk, increasing adaptive capacity and capitalizing on climate change (Juhola, et al. 2017). Their maladaptive outcomes are most likely to affect negatively the practitioners themselves, but also other actors, sectors and the environment (Neset et al fc). With limited research on adaptation

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decision-making in the Nordic context, attention needs to be aimed at the practitioners and their risk perceptions, to better understand farm-scale adaptation processes and related maladaptation outcomes. In this paper, preliminary findings about the relation between the climate risk perceptions and adaptation decision-making at Finnish crop farms are presented.

Methodology

Theoretical Framework

Protection motivation theory (PMT) (Norman, Boer & Seydel 2005) defines adaptation as action following an individual assessment of risk and the risk-response capability. In the context of agriculture and climate change adaptation, the theory has been used to explain adaptation behavior as a logic model (Dang et al 2014; Grottham & Patt 2005) presented in **Figure 1.**

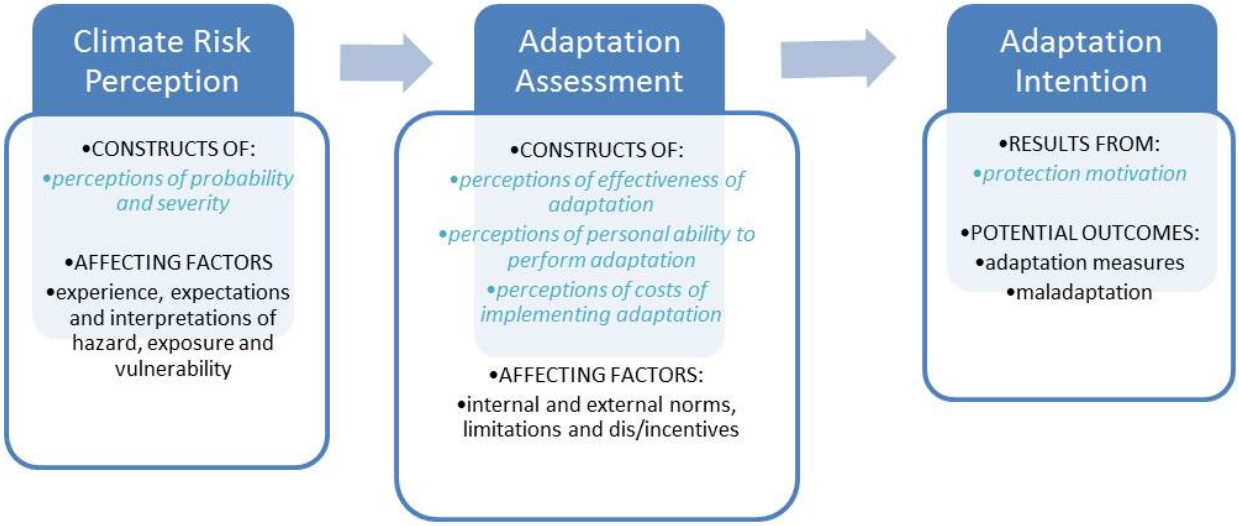

Figure 1. Risk perception driven adaptation decision-making model based on protection motivation theory (PMT). Original PMT variables are in italics (Source: Applied from Dang et al 2014; Grottham & Patt 2005).

The climate risk perception is a personal reflection of contextual and spatially specific risk factors, such as the occurrence of hazardous events and sectoral vulnerability. It is affected by psycho-socio-cultural variables, such as experiences of vulnerability. When the risk is perceived high enough, an assessment of the adaptation success may follow. The assessment is directed towards the effectiveness of personal capabilities to perform and the costs of adaptation. Factors like financial incentives, social norms and personal beliefs affect the setting of boundaries to the assessment. Adaptation intention rises from the motivation to protect against the climate

risk when adaptation is perceived possible and beneficial. As a result, adaptation measures may be implemented with potential consequence of maladaptation.

Methods and materials

Due to the novelty of the study topic, a case study approach and in-depth semi-structured stakeholder interviews were applied. The case of the Finnish Uusimaa region offers an agricultural context that is claimed to be vulnerable to, but also potentially benefiting from, climate change. Adaptation measures with potential maladaptive outcomes are implemented in the region (Neset, et al. fc).

The interviewed farmers and extension officers were snowball sampled until a saturation point at 13 interviews was reached. The interviews were held one-on-one at interviewees' homes or workplaces; recorded, and transcribed in verbatim. The theoretical framework was used in designing the interview guide and in detecting the variables and affecting factors of the adaptation decision-making. Qualitative content analysis and explanation building (Yin 2014) were iteratively used in analyzing the relation between risk perceptions and farm-scale adaptation.

Results

The climate risk perceptions in the study region are based on expectations of climate risks becoming more severe and probable, with variation in the nature and time-scales of the expected risks. Experiences, values and preferences cause the main differences between perceptions. For example, vicinity of a flood on the best field combined with a strong preference on cultivating flood-sensitive crop variety correlates with a risk perception highlighting the severity of increased precipitation and floods. An experience of vulnerability in failing to protect another asset from another type of climate hazard changes the perception.

Knowledge on adaptation is poorly disseminated among the agricultural practitioners in the study region. The global markets and EU agricultural policies are perceived as an important external factor in the adaptation assessments. However, the internal factors causing varying perceptions of the costs and efficacy of the adaptation measures affect the assessment significantly. For example, taking up a new crop to cultivation was assessed as a low-cost measure for a large-scale conventional farmer, who has financial buffer via other assets, and option for using effective pesticides in case of an alien pest invasion. A small-scale organic farmer with limitations of space, finance and pest control, on the other hand, assessed the costs of introducing a new crop to circulation much higher.

The identified intentions for adaptation in the region derive from motivation to protect firstly the farm practice, investments and assets. However, the logic behind intended measures vary regarding the aims and time-horizons of the adaptation outcomes and the related maladaptation. Risk reductive measures, such as irrigation during a dry-spell, reflect short-term oriented risk aversive logic, which holds potential for maladaptation in the longer term. The adaptive capacity building measures, such as enhancing sub-soil drainage or investing in precise machinery, result from a logic driven by the aim to adapt to climate change in the long-term with an experimental approach. Measures for capitalizing on climate change - for example, introducing new varieties - are firstly targeted for profiting regardless of the time-scale of the expected adaptation. The trial and error logic of experimental adaptation, as well as the risk-seeking logic of profit-oriented adaptation, pose potential to maladaptation related to failed adaptation. For example, a novel crop attracting new pests to the region or an investment on direct-sowing machinery causing financial losses, along with unfavorable regulation or market condition changes.

Conclusions

The study shows that climate risks are deliberated at farm-scale and they generate the implementation of adaptation measures that reflect the farmers' risk-response logic. The results underline the dynamic and contextual nature of adaptation at farm scale. Depending on factors such as personal experiences with climate extremes, preferences for crop varieties, and on how dependent the production orientation is to, for example, market fluctuation, the risks are perceived and adaptation assessed differently.

The study also shows how adaptation is addressed without adaptation policy guidance on farm-scale in a Nordic region that plays a significant role in national crop yield production. This implies an impact of climatic risks beyond the regional population and economy. It thus implies that farmers are put into a responsibility position regarding national food security and agricultural productivity. In that pressing position, they are facing challenging climatic changes without sufficient knowledge, nor economic resources for implementing well-scheduled, long-term adaptation that would also avoid maladaptive outcomes. This study hence points towards the need of adaptation policies that acknowledge the varying logics behind adaptation decision-making. More importantly, the practical adaptation skills and knowledge of farmers should be acknowledged. Co-operating with stakeholders in participatory policy planning, and acknowledging the experimental farmers as "early adopters" are suggested for practical next steps.

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